Eco-efficiency opportunities fact sheet
Manufacturers and Processors: Waste Heat

DALHOUSIE UNIVERSITY ECO EFFICIENCY CENTRE

Introduction

eco|efficiency PROGRAM FOR MANUFACTURERS *Take the Green Path*

The Eco-Efficiency Program for Manufacturers (E2PM) was created by Dalhousie University's Eco-Efficiency Centre to help small- to medium-sized manufacturers and processors, across Nova Scotia, identify eco-efficiency and pollution prevention opportunities. The program focused on business initiatives to reduce costs by utilizing energy, water, and materials more efficiently. The program consisted of four components, two offered by Eco-Efficiency Centre staff and two by private consultants. Both Eco-Efficiency Centre staff and consultants conducted site visits of local manufacturers and prepared recommendations on opportunities available. Formal opportunity and implementation assessment reports were prepared by the consultants for participating companies.

Before the program ended, in March 2009, data was collected from 70 Nova Scotian companies on various eco-efficiency and pollution prevention opportunities. A survey of a subset of these 70 companies, that recorded savings from implemented opportunities, identified 2.8 million dollars saved and over 8000 tonnes annually of greenhouse gas reductions over the life of the project. It should be noted that these numbers show only quantifiable results. Additional companies benefitted from the program but were unable to quantify their savings at the time of the survey.

To demonstrate common trends found in opportunity and implementation assessments, data was compiled and sorted to identify the top five most common recommendations with examples of specific recommendations from each category.

Recommendation

Extraction of waste heat from equipment.

Rank

This recommendation was suggested to 67% of E2PM participants, making it the second most common recommendation.

Details

Industrial processes and equipment often create large amounts of heat as a by-product. The efficiency of a process is measured by the ration of usable output energy to input energy. By that standard many things such as compressors or combustion engines have efficiencies in the range of 10-30%. This means that in reality they are much better at producing heat than they are at producing compressed air and mechanical energy, respectively. While many people view heat by-products as waste it can often be harvested for secondary purposes.

Sourced from: http://www.ritai-fermenter.com

The waste heat expelled in the air can be used in a variety of applications, depending on the temperature. Common sources for waste heat are combustion processes, e.g. generators, compressors, wastewater and flue gases. A heat exchanger can use lower grade heat to preheat domestic water. This air can also be ducted from the unit to be used for space heating. Waste water can also be used in a closed loop system to preheat domestic water and provide space heating; this process promotes efficient heat and water use.

Higher grade heat sources (>60^{o}C), such as flue gases and exhaust fumes, can be used to fully heat domestic water systems or to preheat the return stream for a boiler. Heat exchange systems become more efficient at higher temperatures and can attain efficiencies up to 80%. Preheating boiler return can increase the efficiency of the unit significantly, saving fuel in the process. The most efficient way to capture and utilize the heat is to create a closed loop system between the boiler return and the heat exchanger.

Payback Period

Payback periods for waste heat recovery can vary dramatically depending on the application. Simple changes such as heating a space with the exhaust of a compressor requires only a small change in ductwork, and can pay for itself in less than a year. Larger changes such as the installation of a heat exchanger can have payback periods in the 2-4 year range.

Below is a sample calculation for heat recovery of a compressed air system.

0.8 * (Compressor BHP) * 2545 btu(heat)/(bhp*hr)) hours/year = Annual Energy Savings
([Annual Energy Savings]/[btu/unit fuel] * [Cost/unit fuel]) / Primary Heating Efficiency = Annual Cost Savings

0.8 is the assumed 80% of heat captured
2545 is the amount of heat generated each hour in btu per bhp.

Company Examples

A report completed by Enerscan with a local food processor recommended the recovery of heat from their main dryer, which used a large amount of energy. The total cost of the installation, including design, a heat exchanger and a control system was $150,000. The retrofit was conservatively estimated to capture 40% of the heat lost, which equated to 200,000 L of propane each year and an annual savings of $100,000. This gave the project a 1.5 year payback period and an annual reduction of 300 tonnes of CO_2e.

A textile company had an opportunity assessment completed by Nova Dynamics. The report determined that the power room, containing three transformers, generated enough waste heat to justify using it to heat the production space. The project called for the installation of a fan and appropriate damper to use the 4.8kW of energy to heat the space. The cost of the upgrades was estimated at $1500 with an annual savings of $1800, generating a payback period of less than one year.

This eco-efficiency opportunities fact sheet was prepared by the *Eco-Efficiency Centre*, a non-profit, non-government educational and environmental management support centre for small- and medium-sized enterprises in Nova Scotia. The Eco-Efficiency Centre was established in 1998 as a partnership between Dalhousie University and Nova Scotia Power Inc., and is supported by private corporations, governments and foundations. The Centre assists companies to achieve better environmental and economic performance through resource conservation, pollution prevention, recycling, reuse, and general good environmental practices.